EXERCISE 12.1

1. y and z - coordinates are zero **2.** y - coordinate is zero
3. I, IV, VIII, V, VI, II, III, VII
4. (i) XY - plane (ii) $(x, y, 0)$ (iii) Eight

EXERCISE 12.2

1. (i) $2\sqrt{5}$ (ii) $\sqrt{43}$ (iii) $2\sqrt{26}$ (iv) $2\sqrt{5}$
4. $x - 2z = 0$ **5.** $9x^2 + 25y^2 + 25z^2 - 225 = 0$

EXERCISE 12.3

1. (i) $\left(\frac{-4}{5}, \frac{1}{5}, \frac{27}{5}\right)$ (ii) $(-8, 17, 3)$ **2.** 1 : 2
3. 2 : 3 **5.** (6, – 4, – 2), (8, – 10, 2)

Miscellaneous Exercise on Chapter 12

1. (1, – 2, 8) **2.** $7, \sqrt{34}, 7$ **3.** $a = -2,\ b = -\frac{16}{3},\ c = 2$
4. (0, 2, 0) and (0, – 6, 0)
5. (4, – 2, 6) **6.** $x^2 + y^2 + z^2 - 2x - 7y + 2z = \frac{k^2 - 109}{2}$

EXERCISE 13.1

1. 6 **2.** $\left(\pi - \frac{22}{7}\right)$ **3.** π **4.** $\frac{19}{2}$
5. $-\frac{1}{2}$ **6.** 5 **7.** $\frac{11}{4}$ **8.** $\frac{108}{7}$
9. b **10.** 2 **11.** 1 **12.** $-\frac{1}{4}$
13. $\frac{a}{b}$ **14.** $\frac{a}{b}$ **15.** $\frac{1}{\pi}$ **16.** $\frac{1}{\pi}$

17. 4 **18.** $\frac{a+1}{b}$ **19.** 0 **20.** 1

21. 0 **22.** 2 **23.** 3, 6

24. Limit does not exist at $x = 1$

25. Limit does not exist at $x = 0$ **26.** Limit does not exist at $x = 0$

27. 0 **28.** $a = 0, b = 4$

29. $\lim_{x \to a_1} f(x) = 0$ and $\lim_{x \to a} f(x) = (a - a_1)(a - a_2) \ldots (a - a_x)$

30. $\lim_{x \to a} f(x)$ exists for all $a \neq 0$. **31.** 2

32. For $\lim_{x \to 0} f(x)$ to exists, we need $m = n$; $\lim_{x \to 1} f(x)$ exists for any integral value of m and n.

EXERCISE 13.2

1. 20 **2.** 1 **3.** 99

4. (i) $3x^2$ (ii) $2x - 3$ (iii) $\frac{-2}{x^3}$ (iv) $\frac{-2}{(x-1)^2}$

6. $nx^{n-1} + a(n-1)x^{n-2} + a^2(n-2)x^{n-3} + \ldots + a^{n-1}$

7. (i) $2x - a - b$ (ii) $4ax\left(ax^2 + b\right)$ (iii) $\frac{a-b}{(x-b)^2}$

8. $\frac{nx^n - anx^{n-1} - x^n + a^n}{(x-a)^2}$

9. (i) 2 (ii) $20x^3 - 15x^2 + 6x - 4$ (iii) $\frac{-3}{x^4}(5 + 2x)$ (iv) $15x^4 + \frac{24}{x^5}$

(v) $\frac{-12}{x^5} + \frac{36}{x^{10}}$ (vi) $\frac{-2}{(x+1)^2} - \frac{x(3x-2)}{(3x-1)^2}$ **10.** $-\sin x$

11. (i) $\cos 2x$ (ii) $\sec x \tan x$

(iii) $5\sec x \tan x - 4\sin x$ (iv) $-\operatorname{cosec} x \cot x$

(v) $-3\operatorname{cosec}^2 x - 5 \operatorname{cosec} x \cot x$ (vi) $5\cos x + 6\sin x$

(vii) $2\sec^2 x - 7\sec x \tan x$

Miscellaneous Exercise on Chapter 13

1. (i) – 1 (ii) $\frac{1}{x^2}$ (iii) cos $(x + 1)$ (iv) $-\sin\left(x-\frac{\pi}{8}\right)$ **2.** 1

3. $\frac{-qr}{x^2}+ps$ **4.** $2c\,(ax+b)\,(cx+d)+a\,(cx+d)^2$

5. $\frac{ad-bc}{(cx+d)^2}$ **6.** $\frac{-2}{(x-1)^2},\ x\neq 0,1$ **7.** $\frac{-(2ax+b)}{\left(ax^2+bx+c\right)^2}$

8. $\frac{-apx^2-2bpx+ar-bq}{\left(px^2+qx+r\right)^2}$ **9.** $\frac{apx^2+2bpx+bq-ar}{(ax+b)^2}$ **10.** $\frac{-4a}{x^5}+\frac{2b}{x^3}-\sin x$

11. $\frac{2}{\sqrt{x}}$ **12.** $na(ax+b)^{n-1}$

13. $(ax+b)^{n-1}(cx+d)^{m-1}\left[mc(ax+b)+na(cx+d)\right]$ **14.** cos $(x+a)$

15. $-\operatorname{cosec}^3 x-\operatorname{cosec} x\cot^2 x$ **16.** $\frac{-1}{1+\sin x}$

17. $\frac{-2}{(\sin x-\cos x)^2}$ **18.** $\frac{2\sec x\tan x}{(\sec x+1)^2}$ **19.** $n\sin^{n-1}x\cos x$

20. $\frac{bc\cos x+ad\sin x+bd}{(c+d\cos x)^2}$ **21.** $\frac{\cos a}{\cos^2 x}$

22. $x^3(5x\cos x+3x\sin x+20\sin x-12\cos x)$

23. $-x^2\sin x-\sin x+2x\cos x$

24. $-q\sin x\left(ax^2+\sin x\right)+(p+q\cos x)(2a\,x+\cos x)$

25. $-\tan^2 x(x+\cos x)+(x-\tan x)(1-\sin x)$

26. $\frac{35+15x\cos x+28\cos x+28x\sin x-15\sin x}{(3x+7\cos x)^2}$

27. $\dfrac{x\cos\dfrac{\pi}{4}(2\sin x - x\cos x)}{\sqrt{2}\sin^2 x}$ **28.** $\dfrac{1+\tan x - x\sec^2 x}{(1+\tan x)^2}$

29. $(x+\sec x)(1-\sec^2 x)+(x-\tan x).(1+\sec x\tan x)$

30. $\dfrac{\sin x - n\,x\cos x}{\sin^{n+1} x}$

EXERCISE 14.1

1. (i) This sentence is always false because the maximum number of days in a month is 31. Therefore, it is a statement.

(ii) This is not a statement because for some people mathematics can be easy and for some others it can be difficult.

(iii) This sentence is always true because the sum is 12 and it is greater than 10. Therefore, it is a statement.

(iv) This sentence is sometimes true and sometimes not true. For example the square of 2 is even number and the square of 3 is an odd number. Therefore, it is not a statement.

(v) This sentence is sometimes true and sometimes false. For example, squares and rhombus have equal length whereas rectangles and trapezium have unequal length. Therefore, it is not a statement.

(vi) It is an order and therefore, is not a statement.

(vii) This sentence is false as the product is (–8). Therefore, it is a statement.

(viii) This sentence is always true and therefore, it is a statement.

(ix) It is not clear from the context which day is referred and therefore, it is not a statement.

(x) This is a true statement because all real numbers can be written in the form $a + i \times 0$.

2. The three examples can be:

(i) Everyone in this room is bold. This is not a statement because from the context it is not clear which room is referred here and the term bold is not precisely defined.

(ii) She is an engineering student. This is also not a statement because who 'she' is.

(iii) "$\cos^2\theta$ is always greater than 1/2". Unless, we know what θ is, we cannot say whether the sentence is true or not.